

In the claims:

Amend claims 1, 6, 7, 11, 17, 19 and 20 of claims 1-24.

1 1. (Currently Amended) A magnetic head assembly having a head surface
2 comprising:

3 a write head including:

4 ferromagnetic first and second pole pieces that have a yoke portion located between
5 a pole tip portion and a back gap portion;

6 a nonmagnetic write gap layer located between the pole tip portions of the first and
7 second pole pieces;

8 an insulation stack with at least one coil layer embedded therein located between
9 the yoke portions of the first and second pole pieces:

10 the first and second pole pieces being connected at their back gap portions;

11 the pole tip portion of the first pole piece having non-overlapping first and second
12 components wherein the first component forms a portion of the head surface and the
13 second component is recessed from the head surface and is magnetically connected to the
14 first component; and

15 the first and second components having a height into the head assembly which is measured
16 from a centerline that is perpendicular to said head surface;

17 each of the first and second components being located along said centerline so that the
18 centerline bisects each of the first and second components with the second component being an
19 extension of the first component into the head assembly along the centerline;

20 the second component having a width that is less than a width of the first component
21 wherein said widths are parallel to the head surface and parallel to a major plane of the write gap
22 layer;

23 a read head; and

24 the first pole piece being located between the read head and the second pole piece.

1 2. (Previously Presented) A magnetic head assembly as claimed in claim 1
2 further comprising:

3 the first pole piece having a third component that is recessed from the head surface and that
4 has a width that is parallel to the head surface and the major plane of the write gap layer;

5 the second component interconnecting the first and third components; and

6 the width of the third component being greater than the width of the second component.

1 3. (Previously Presented) A magnetic head assembly having an air bearing surface
2 (ABS) and comprising:
3 a write head including:
4 ferromagnetic first and second pole piece layers that have a yoke portion located
5 between a pole tip portion and a back gap portion;
6 a nonmagnetic write gap layer located between the pole tip portions of the first and
7 second pole piece layers;
8 an insulation stack with at least one coil layer embedded therein located between
9 the yoke portions of the first and second pole piece layers;
10 the first and second pole piece layers being connected at their back gap portions;
11 the pole tip portion of the first pole piece layer having first and second components
12 wherein the first component forms a portion of the ABS and the second component is
13 recessed from the ABS and is magnetically connected to the first component;
14 the second component having a width that is less than a width of the first
15 component wherein said widths are parallel to the ABS and parallel to a major plane of the
16 write gap layer;
17 the first pole piece layer having a third component that is recessed from the ABS
18 and having a width that is parallel to the ABS and the major thin film plane of the write
19 gap layer;
20 the second component interconnecting the first and third components;
21 the width of the third component being greater than the width of the second
22 component;
23 the first pole piece layer having a base layer and a pedestal wherein the pedestal
24 forms a portion of the ABS; and
25 the pedestal interconnecting the base layer and the first component.

1 4. (Previously Presented) A magnetic head assembly as claimed in claim 1 further
2 comprising:
3 the read head including:
4 a read sensor;
5 nonmagnetic electrically nonconductive first and second read gap layers;
6 the read sensor being located between the first and second read gap layers;
7 a ferromagnetic first shield layer; and
8 the first and second read gap layers being located between the first shield layer and
9 the first pole piece.

1 5. (Previously Presented) A magnetic head assembly as claimed in claim 4 further
2 comprising:
3 the first pole piece having a third component that is recessed from the ABS and has a width
4 that is parallel to the head surface and a major plane of the write gap layer;
5 the second component interconnecting the first and third components; and
6 the width of the third component being greater than the width of the second component.

1 6. (Currently Amended) A magnetic head assembly having an air bearing surface
2 (ABS) and comprising:
3 a write head including:
4 ferromagnetic first and second pole piece layers that have a yoke portion located
5 between a pole tip portion and a back gap portion;
6 a nonmagnetic write gap layer located between the pole tip portions of the first and
7 second pole piece layers;
8 an insulation stack with at least one coil layer embedded therein located between
9 the yoke portions of the first and second pole piece layers;
10 the first and second pole piece layers being connected at their back gap portions;
11 the pole tip portion of the first pole piece layer having first and second components
12 wherein the first component forms a portion of the ABS and the second component is
13 recessed from the ABS and is magnetically connected to the first component;

14 the first and second components having a height into the head assembly which is
15 measured from a centerline that is perpendicular to said ABS;

16 each of the first and second components being located along said centerline so that
17 the centerline bisects each of the first and second components with the second component
18 being an extension of the first component into the head assembly along the centerline;

19 the second component having a width that is less than a width of the first
20 component wherein said widths are parallel to the ABS and parallel to a major plane of the
21 write gap layer;

22 the first pole piece layer having a third component that is recessed from the ABS
23 and having a width that is parallel to the ABS and the major thin film plane of the write
24 gap layer;

25 the second component interconnecting the first and third components;

26 the width of the third component being greater than the width of the second
27 component;

28 the first pole piece layer having a base layer and a pedestal wherein the pedestal
29 forms a portion of the ABS; and

30 the pedestal interconnecting the base layer and the first component.;

31 a read head including:

32 a read sensor;

33 nonmagnetic electrically nonconductive first and second read gap layers;

34 the read sensor being located between the first and second read gap layers;

35 a ferromagnetic first shield layer; and

36 the first and second read gap layers being located between the first shield layer and
37 the first pole piece layer.

1 7. (Currently Amended) A magnetic disk drive including at least one magnetic
2 head assembly that has a head surface and that includes a write head and a read head, comprising:

3 the write head including:

4 ferromagnetic first and second pole pieces that have a yoke portion located between
5 a pole tip portion and a back gap portion;

6 a nonmagnetic write gap layer located between the pole tip portions of the first and
7 second pole pieces:

8 an insulation stack with at least one coil layer embedded therein located between
9 the yoke portions of the first and second pole pieces:

10 the first and second pole pieces being connected at their back gap portions;

11 the pole tip portion of the first pole piece having non-overlapping first and second
12 components wherein the first component forms a portion of the head surface and the
13 second component is recessed from the head surface and is magnetically connected to the
14 first component; and

15 the first and second components having a height into the head assembly which is
16 measured from a centerline that is perpendicular to said head surface;

17 each of the first and second components being located along said centerline so that
18 the centerline bisects each of the first and second components with the second component
19 being an extension of the first component into the head assembly along the centerline;

20 the second component having a width that is less than a width of the first
21 component wherein said widths are parallel to the head surface and parallel to a major
22 plane of the write gap layer;

23 the read head including:

24 a read sensor;

25 nonmagnetic electrically nonconductive first and second read gap layers;

26 the read sensor being located between the first and second read gap layers;

27 a ferromagnetic first shield layer; and

28 the first and second read gap layers being located between the first shield layer and
29 the first pole piece;

30 the first pole piece being located between the read head and the second pole piece;

31 a housing;

32 a magnetic disk rotatably supported in the housing;

33 a support mounted in the housing for supporting the magnetic head assembly with said
34 head surface facing the magnetic disk so that the magnetic head assembly is in a transducing
35 relationship with the magnetic disk;

36 a spindle motor for rotating the magnetic disk;

37 an actuator positioning means connected to the support for moving the magnetic head
38 assembly to multiple positions with respect to said magnetic disk; and

39 a processor connected to the magnetic head assembly, to the spindle motor and to the
40 actuator positioning means for exchanging signals with the magnetic head assembly, for
41 controlling movement of the magnetic disk and for controlling the position of the magnetic head
42 assembly.

1 8. (Previously Presented) A magnetic disk drive as claimed in claim 7 further
2 comprising:

3 the first pole piece layer having a third component that is recessed from the head surface
4 and has a width that is parallel to the head surface and the major plane of the write gap layer;
5 the second component interconnecting the first and third components; and
6 the width of the third component being greater than the width of the second component.

1 9. (Previously Presented) A magnetic disk drive including at least one magnetic
2 head assembly that has an air bearing surface (ABS) and that includes a write head and a read
3 head, comprising:

4 the write head including:

5 ferromagnetic first and second pole piece layers that have a yoke portion located
6 between a pole tip portion and a back gap portion;

7 a nonmagnetic write gap layer located between the pole tip portions of the first and
8 second pole piece layers;

9 an insulation stack with at least one coil layer embedded therein located between
10 the yoke portions of the first and second pole piece layers;

11 the first and second pole piece layers being connected at their back gap portions;

12 the pole tip portion of the first pole piece layer having first and second components
13 wherein the first component forms a portion of the ABS and the second component is
14 recessed from the ABS and is magnetically connected to the first component;

15 the second component having a width that is less than a width of the first
16 component wherein said widths are parallel to the ABS and parallel to a major thin film
17 plane of the write gap layer;

18 the read head including:

19 a read sensor;

20 nonmagnetic electrically nonconductive first and second read gap layers;

21 the read sensor being located between the first and second read gap layers;
22 a ferromagnetic first shield layer;
23 the first and second read gap layers being located between the first shield layer and
24 the first pole piece layer;
25 the first pole piece layer having a base layer and a pedestal wherein the pedestal
26 forms a portion of the ABS; and
27 the pedestal interconnecting the base layer and the first component-;
28 a housing;
29 a magnetic disk rotatably supported in the housing;
30 a support mounted in the housing for supporting the magnetic head assembly with said
31 ABS facing the magnetic disk so that the magnetic head assembly is in a transducing relationship
32 with the magnetic disk;
33 a spindle motor for rotating the magnetic disk;
34 an actuator positioning means connected to the support for moving the magnetic head
35 assembly to multiple positions with respect to said magnetic disk; and
36 a processor connected to the magnetic head assembly, to the spindle motor and to the
37 actuator positioning means for exchanging signals with the magnetic head assembly, for
38 controlling movement of the magnetic disk and for controlling the position of the magnetic head
39 assembly.

1 10. (Original) A magnetic disk drive as claimed in claim 9 further comprising:
2 the first pole piece layer having a third component that is recessed from the ABS and has
3 a width that is parallel to the ABS and the major thin film planes of the layers of the sensor;
4 the second component interconnecting the first and third components; and
5 the width of the third component being greater than the width of the second component.

1 11. (Currently Amended) A method of making a magnetic head assembly having a
2 head surface comprising the steps of:
3 making a write head including the steps of:
4 forming ferromagnetic first and second pole pieces that have a yoke portion located
5 between a pole tip portion and a back gap portion;

6 forming a nonmagnetic write gap layer between the pole tip portions of the first and
7 second pole pieces;
8 forming an insulation stack with at least one coil layer embedded therein between
9 the yoke portions of the first and second pole pieces;
10 connecting the first and second pole pieces at their back gap portions;
11 forming the pole tip portion of the first pole piece with non-overlapping first and
12 second components wherein the first component forms a portion of the head surface and
13 the second component is recessed from the head surface and is magnetically connected to
14 the first component;
15 forming the first and second components with a height into the head assembly
16 which is measured from a centerline that is perpendicular to said head surface;
17 forming each of the first and second components along said centerline so that the
18 centerline bisects each of the first and second components with the second component
19 being an extension of the first component into the head assembly along the centerline;
20 forming the second component with a width that is less than a width of the first
21 component wherein said widths are parallel to the head surface and parallel to a major
22 plane of the write gap layer; and
23 forming a read head with the first pole piece located between the read head and the
24 second pole piece.

1 12. (Previously Presented) A method of making a magnetic head assembly as
2 claimed in claim 11 further comprising the steps of:

3 forming the first pole piece layer with a third component that is recessed from the head
4 surface and with a width that is parallel to the head surface and the major plane of the write gap
5 layer;
6 forming the second component interconnecting the first and third components; and
7 forming the width of the third component greater than the width of the second component.

1 13. (Previously Presented) A method of making a magnetic head assembly having
2 an air bearing surface (ABS) and comprising the steps of:

3 making a write head including the steps of:
4 forming ferromagnetic first and second pole piece layers that have a yoke portion
5 located between a pole tip portion and a back gap portion;

6 forming a nonmagnetic write gap layer between the pole tip portions of the first and
7 second pole piece layers;

8 forming an insulation stack with at least one coil layer embedded therein between
9 the yoke portions of the first and second pole piece layers;

10 connecting the first and second pole piece layers at their back gap portions;

11 forming the pole tip portion of the first pole piece layer with first and second
12 components wherein the first component forms a portion of the ABS and the second
13 component is recessed from the ABS and is magnetically connected to the first component;
14 and

15 forming the second component with a width that is less than a width of the first
16 component wherein said widths are parallel to the ABS and parallel to a major thin film
17 plane of the write gap layer;

18 forming the first pole piece layer with a third component that is recessed from the
19 ABS and with a width that is parallel to the ABS and the major thin film plane of the write
20 gap layer;

21 forming the second component interconnecting the first and third components;

22 forming the width of the third component greater than the width of the second
23 component;

24 forming the first pole piece layer with a base layer and a pedestal wherein the
25 pedestal forms a portion of the ABS; and

26 forming the pedestal interconnecting the base layer and the first component.

1 14. (Previously Presented) A method of making a magnetic head assembly as
2 claimed in claim 11 further comprising the steps of:

3 making the read head including the steps of:

4 forming a read sensor;

5 forming nonmagnetic electrically nonconductive first and second read gap layers
6 with the read sensor located between the first and second read gap layers; and

7 forming a ferromagnetic first shield layer with the first and second read gap layers
8 located between the first shield layer and the first pole piece.

1 15. (Previously Presented) A method of making a magnetic head assembly as
2 claimed in claim 14 further comprising the steps of:

3 forming the first pole piece with a third component that is recessed from the head surface
4 and with a width that is parallel to the head surface and the major plane of the write gap layer;
5 forming the second component interconnecting the first and third components; and
6 forming the width of the third component greater than the width of the second component.

1 16. (Previously Presented) A method of making a magnetic head assembly having
2 an air bearing surface (ABS) and comprising the steps of:

3 making a write head including the steps of:

4 forming ferromagnetic first and second pole piece layers that have a yoke portion
5 located between a pole tip portion and a back gap portion;

6 forming a nonmagnetic write gap layer between the pole tip portions of the first and
7 second pole piece layers;

8 forming an insulation stack with at least one coil layer embedded therein between
9 the yoke portions of the first and second pole piece layers;

10 connecting the first and second pole piece layers at their back gap portions;

11 forming the pole tip portion of the first pole piece layer with first and second
12 components wherein the first component forms a portion of the ABS and the second
13 component is recessed from the ABS and is magnetically connected to the first component;
14 and

15 forming the second component with a width that is less than a width of the first
16 component wherein said widths are parallel to the ABS and parallel to a major thin film
17 plane of the write gap layer;

18 forming the first pole piece layer with a third component that is recessed from the
19 ABS and with a width that is parallel to the ABS and the major thin film plane of the write
20 gap layer;

21 forming the second component interconnecting the first and third components;

22 forming the width of the third component greater than the width of the second
23 component;

24 forming the first pole piece layer with a base layer and a pedestal wherein the
25 pedestal forms a portion of the ABS; and

forming the pedestal interconnecting the base layer and the first component;
making a read head including the steps of:
forming a read sensor;
forming nonmagnetic electrically nonconductive first and second read gap layers
with the read sensor located between the first and second read gap layers; and
forming a ferromagnetic first shield layer with the first and second read gap layers
located between the first shield layer and the first pole piece layer.

17. (Currently Amended) A magnetic head assembly having a head surface and
comprising:
a write head including:
ferromagnetic first and second pole pieces that have a yoke portion located between
a pole tip portion and a back gap portion;
a nonmagnetic write gap layer located between said pole tip portions;
an insulation stack with at least one coil layer embedded therein located between
said yoke portions;
the first and second pole pieces being connected at their back gap portions; and
the pole tip portion having of the first pole piece having a full portion and a
reduced cross-section portion wherein the full portion forms a portion of the head surface
and the reduced cross-section portion is located entirely within a region which is recessed
from said head surface;
the first and second portions having a height into the head assembly which is
measured from a centerline that is perpendicular to said head surface;
each of the first and second portions being located along said centerline so that the
centerline bisects each of the first and second portions with the second portion being an
extension of the first portion into the head assembly along the centerline;
a read head; and
the first pole piece being located between the read head and the second pole piece.

1 18. (Previously Presented) A magnetic head assembly as claimed in claim 17 further
2 comprising:

3 the read head including:

4 a read sensor;
5 nonmagnetic electrically nonconductive first and second read gap layers;
6 the read sensor being located between the first and second read gap layers;
7 a ferromagnetic first shield layer; and
8 the first and second read gap layers being located between the first shield layer and
9 the first pole piece.

1 19. (Currently Amended) A magnetic disk drive including at least one magnetic
2 head assembly that has a head surface and that includes a write head and a read head, comprising:

3 the write head including:

4 ferromagnetic first and second pole pieces that have a yoke portion located between
5 a pole tip portion and a back gap portion;

6 a nonmagnetic write gap layer located between said pole tip portions;
7 an insulation stack with at least one coil layer embedded therein located between
8 said yoke portions;

9 the first and second pole pieces being connected at their back gap portions; and

10 the pole tip portion having of the first pole piece having a full portion and a
11 reduced cross-section portion wherein the full portion forms a portion of the head surface
12 and the reduced cross-section portion is located entirely within a region which is recessed
13 from said head surface;

14 the first and second portions having a height into the head assembly which is
15 measured from a centerline that is perpendicular to said head surface;

16 each of the first and second portions being located along said centerline so that the
17 centerline bisects each of the first and second portions with the second portion being an
18 extension of the first portion into the head assembly along the centerline;

19 the read head including:

20 a read sensor;
21 nonmagnetic electrically nonconductive first and second read gap layers;
22 the read sensor being located between the first and second read gap layers;
23 a ferromagnetic first shield layer; and

24 the first and second read gap layers being located between the first shield layer and
25 the first pole piece layer;
26 the first pole piece being located between the read head and the second pole piece;
27 a housing;
28 a magnetic medium supported in the housing;
29 a support mounted in the housing for supporting the magnetic head assembly with said
30 head surface facing the magnetic medium so that the magnetic head assembly is in a transducing
31 relationship with the magnetic medium; and
32 a processor connected to the magnetic head assembly for exchanging signals with the
33 magnetic head assembly.

1 20. (Currently Amended) A method of making a magnetic head assembly having
2 a head surface and comprising the steps of:

3 making a write head including the steps of:

4 forming ferromagnetic first and second pole pieces with a yoke portion located
5 between a pole tip portion and a back gap portion;

6 forming a nonmagnetic write gap layer between said pole tip portions;

7 forming an insulation stack with at least one coil layer embedded therein between
8 said yoke portions;

9 connecting the first and second pole pieces at their back gap portions; and

10 forming the pole tip portion of the first pole piece with a full portion and with a
11 reduced cross-section portion wherein the full portion forms a portion of the head surface
12 and the reduced cross-section portion is located entirely within a region which is recessed
13 from said head surface; and

14 forming the first and second portions with a height into the head assembly which
15 is measured from a centerline that is perpendicular to said head surface;

16 forming each of the first and second portions along said centerline so that the
17 centerline bisects each of the first and second portions with the second portion being an
18 extension of the first portion into the head assembly along the centerline;

19 forming a read head with the first pole piece located between the read head and the
20 second pole piece.

1 21. (Previously Presented) A magnetic head assembly that has a head surface
2 comprising:

3 a write head including:

4 ferromagnetic first and second pole piece layers that have a yoke portion located
5 between a pole tip portion and a back gap portion;

6 a nonmagnetic write gap layer located between the pole tip portions of the first and
7 second pole piece layers;

8 an insulation stack with at least one coil layer embedded therein located between
9 the yoke portions of the first and second pole piece layers;

10 the first and second pole piece layers being connected at their back gap portions;

11 the pole tip portion of the first pole piece layer having first and second components
12 wherein the first component forms a portion of the head surface and the second component
13 is recessed from the head surface and is magnetically connected to the first component;

14 the second component having a width that is less than a width of the first
15 component wherein said widths are parallel to the head surface and parallel to a major thin
16 film plane of the write gap layer;

17 the first pole piece layer having a base layer and a pedestal wherein the pedestal
18 forms a portion of the head surface and is located between the head surface and the
19 insulation stack; and

20 the pedestal interconnecting the base layer and the first component.

1 22. (Previously Presented) A magnetic head assembly as claimed in claim 21 further
2 comprising:

3 a read head; and

4 the first pole piece layer being located between the read head and the second pole piece
5 layer.

1 23. (Previously Presented) A method of making a magnetic head assembly that has
2 a head surface comprising the steps of:

3 making a write head including the steps of:

4 forming ferromagnetic first and second pole piece layers that have a yoke portion
5 located between a pole tip portion and a back gap portion;

6 forming a nonmagnetic write gap layer between the pole tip portions of the first and
7 second pole piece layers;

8 forming an insulation stack with at least one coil layer embedded therein located
9 between the yoke portions of the first and second pole piece layers;

10 connecting the first and second pole piece layers at their back gap portions;

11 forming the pole tip portion of the first pole piece layer with first and second
12 components wherein the first component forms a portion of the head surface and the
13 second component is recessed from the head surface and is magnetically connected to the
14 first component;

15 forming the second component with a width that is less than a width of the first
16 component wherein said widths are parallel to the head surface and parallel to a major thin
17 film plane of the write gap layer;

18 forming the first pole piece layer with a base layer and a pedestal wherein the
19 pedestal forms a portion of the head surface and is located between the head surface and
20 the insulation stack; and

21 forming the pedestal to interconnect the base layer and the first component.

1 24. (Previously Presented) A method as claimed in claim 23 further comprising the
2 step of:

3 forming a read head with the first pole piece layer located between the read head and the
4 second pole piece layer.